INDOOR AIR QUALITY ASSESSMENT

Pompositticut School
511 Great Road
Stow, MA 01775

Prepared by:
Massachusetts Department of Public Health
Center for Environmental Health
Emergency Response/Indoor Air Quality Program
September 2005

Background/Introduction

At the request of a parent, the Massachusetts Department of Public Health's (MDPH) Center for Environmental Health (CEH) conducted an indoor air quality assessment at the Pompositticut School (PS), 511 Great Road, Stow, Massachusetts. On April 27, 2005, a visit to conduct an indoor air quality assessment was made to the PS by Sharon Lee, an Environmental Analyst in CEH's Emergency Response/Indoor Air Quality (ER/IAQ) Program. The request was prompted by general concerns of indoor air quality.

The PS is a single story building constructed in 1971. During 2004, the amphitheatre was converted into classrooms. The school contains a gymnasium, computer room, art room, music room, offices, general classrooms and a kindergarten wing. First and second grade classrooms are in an open pod system arrangement, where classes are separated by movable walls/dividers. Windows are openable throughout the building.

Methods

Air tests for carbon monoxide, carbon dioxide, temperature and relative humidity were conducted with the TSI, Q-Trak, IAQ Monitor, Model 8551. Air tests for airborne particle matter with a diameter less than 2.5 micrometers were taken with the TSI, DUSTTRAK™ Aerosol Monitor Model 8520. Screening for total volatile organic compounds (TVOCs) was conducted using a Thermo Environmental Instruments Inc., Model 580 Series Photo Ionization Detector (PID). MDPH staff also performed visual inspection of building materials for water damage and/or microbial growth.

Results

This school has approximately 290 students and an employee population of approximately 40. Tests were taken under normal operating conditions and results appear in Table 1.

Discussion

Ventilation

It can be seen from Table 1 that carbon dioxide levels were elevated above 800 parts per million (ppm) in six of thirty areas surveyed, indicating adequate air exchange in most areas. It is important to note that the majority of areas tested were empty or sparsely populated at the time of the assessment. Low occupancy can greatly reduce carbon dioxide levels. Carbon dioxide levels would be expected to be higher with full occupancy and with windows shut.

Fresh air is supplied to exterior classrooms by unit ventilator (univent) systems (Picture 1). A univent draws air from outdoors through a fresh air intake located on the exterior wall of the building (Picture 2) and returns air through an air intake located at the base of the unit (Figure 1). Fresh and return air are mixed, filtered, heated and provided to classrooms through an air diffuser located in the top of the unit. Univents were operating in all but one area surveyed at the time of the assessment. Obstructions to airflow, such as desks and other items located on or in front of univent return vents, were also seen in a few classrooms (Picture 3). In one area, a dust broom was placed in front of a univent (Picture 1), which can draw in dust and aerosolize it throughout the classroom. In some converted classrooms, ledges were observed at the same height as the univent return vents (Picture 4), which increases the potential for the return vent to be blocked by items. To function as designed, univents must remain free of obstructions and allowed to operate.

Exhaust ventilation in exterior classrooms is provided by ceiling-mounted exhaust vents (Picture 5), which are ducted to motorized rooftop fans (Picture 6). The exhaust vents appeared to be drawing weakly in some areas (Table 1). Without proper exhaust ventilation, environmental pollutants can build up in the indoor environment and lead to indoor air quality/comfort complaints.

Mechanical ventilation for the open pod classroom areas and the gymnasium is provided by rooftop air handling units (AHUs). Fresh air is supplied by ceiling diffusers (Picture 7). Return air is ducted back to AHUs via wall- or ceiling-mounted return vents (Pictures 8). In addition to mechanical ventilation, classrooms in the pod area also have ceiling fans (Picture 9). These ceiling fans help to circulate air within the room, especially during warmer months when windows are open.

To maximize air exchange, the MDPH recommends that ventilation equipment operate continuously during periods of school occupancy. In order to have proper ventilation with a mechanical supply and exhaust system, the systems must be balanced to provide an adequate amount of fresh air to the interior of a room while removing stale air from the room. It is recommended that existing ventilation systems be re-balanced every five years to ensure adequate air systems function (SMACNA, 1994). The date of the last servicing and balancing was not available at the time of the assessment.

The Massachusetts Building Code requires that each room have a minimum ventilation rate of 15 cubic feet per minute (cfm) per occupant of fresh outside air or openable windows (SBBRS, 1997; BOCA, 1993). The ventilation must be on at all times that the room is occupied. Providing adequate fresh air ventilation with open windows and maintaining the temperature in the comfort range during the cold weather season is impractical. Mechanical ventilation is usually required to provide adequate fresh air ventilation.

Carbon dioxide is not a problem in and of itself. It is used as an indicator of the adequacy of the fresh air ventilation. As carbon dioxide levels rise, it indicates that the ventilating system is malfunctioning or the design occupancy of the room is being exceeded. When this happens a buildup of common indoor air pollutants can occur, leading to discomfort or health complaints. The Occupational Safety and Health Administration (OSHA) standard for carbon dioxide is 5,000 parts per million parts of air (ppm). Workers may be exposed to this level for 40 hours/week, based on a time-weighted average (OSHA, 1997).

The MDPH uses a guideline of 800 ppm for publicly occupied buildings. A guideline of 600 ppm or less is preferred in schools due to the fact that the majority of occupants are young and considered to be a more sensitive population in the evaluation of environmental health status. Inadequate ventilation and/or elevated temperatures are major causes of complaints such as respiratory, eye, nose and throat irritation, lethargy and headaches. For more information concerning carbon dioxide, please see Appendix B.

The temperature measurements ranged from 73^{o} F to 75^{o} F, which were within the MDPH recommended comfort guidelines (Table 1). The MDPH recommends that indoor air temperatures be maintained in a range of 70^{o} F to 78^{o} F in order to provide for the comfort of building occupants. In many cases concerning indoor air quality, fluctuations of temperature in occupied spaces are typically experienced, even in a building with an adequate fresh air supply.

The relative humidity measurements ranged from 41 to 50 percent, which were also within the MDPH recommended comfort range in all areas the day of the assessment. The MDPH recommends a comfort range of 40 to 60 percent for indoor air relative humidity. The sensation of dryness and irritation is common in a low relative humidity environment. Relative humidity levels in the building would be expected to drop during the winter months due to heating. Low relative humidity is a very common problem during the heating season in the northeast part of the United States.

Microbial/Moisture Concerns

A number of areas had water-stained ceiling plaster/ceiling tiles, indicating past roof and/or plumbing leaks (Picture 10). Water-damaged ceiling tiles can provide a source of mold growth and should be replaced after a water leak is discovered and repaired. Water-damaged ceiling plaster is not a source for mold growth; however, moistened dust trapped in spaces between the paint layers can become mold growth media. Water-damaged ceiling plaster should be cleaned and disinfected with an appropriate anti-microbial agent to prevent any growth from occurring.

The American Conference of Governmental Industrial Hygienists (ACGIH) and United States Environmental Protection Agency (US EPA) recommend that porous materials be dried with fans and heating within 24 to 48 hours of becoming wet (ACGIH, 1989; US EPA, 2001). If items are not dried within this time frame, mold growth may occur. The application of a mildewcide to mold colonized porous materials (i.e., ceiling tiles) is not recommended.

Plants were noted in several classrooms. Some plants were placed on paper products and carpeting; water-damaged porous materials can serve as a source for mold growth (Pictures 11 and 12). In addition, plants were observed in close proximity to univent fresh air intakes around the building exterior (Picture 13). Plants should be properly maintained and equipped with drip pans. Plants should not be placed on porous materials to prevent mold growth. Plants should also be located away from ventilation sources (e.g. univents, openable windows, univent fresh air intakes) to prevent entrainment and aerosolization of dirt, pollen or mold.

A number of breaches were noted around the building exterior. Missing mortar was noted in a number of areas (Picture 14). In addition, a window frame was observed to be damaged (Picture 15). Holes, breaches, and seams are points through which water can penetrate the building, particularly under driving rain conditions.

Other Concerns

Indoor air quality can also be adversely impacted by the presence of respiratory irritants, such as products of combustion. The process of combustion produces a number of pollutants. Common combustion products include carbon monoxide, carbon dioxide, water vapor and smoke (fine airborne particle material). Of these materials, exposure to carbon monoxide and particulate matter with a diameter of 2.5 micrometers (μm) or less (PM2.5) can produce immediate, acute health effects upon exposure. To determine whether combustion products were present in the school environment, MDPH staff obtained measurements for carbon monoxide and PM2.5.

Carbon monoxide is a by-product of incomplete combustion of organic matter (e.g., gasoline, wood and tobacco). Exposure to carbon monoxide can produce immediate and acute health affects. Several air quality standards have been established to address carbon monoxide pollution and prevent symptoms from exposure to these substances. The MDPH established a corrective action level concerning carbon monoxide in ice skating rinks that use fossil-fueled ice resurfacing equipment. If an operator of an indoor ice rink measures a carbon monoxide level over 30 ppm, taken 20 minutes after resurfacing within a rink, that operator must take actions to reduce carbon monoxide levels (MDPH, 1997).

ASHRAE has adopted the National Ambient Air Quality Standards (NAAQS) as one set of criteria for assessing indoor air quality and monitoring of fresh air introduced by HVAC systems (ASHRAE, 1989). The NAAQS are standards established by the US EPA to protect the public health from six criteria pollutants, including carbon monoxide and particulate matter (US EPA, 2000a). As recommended by ASHRAE, pollutant levels of fresh air introduced to a building should not exceed the NAAQS (ASHRAE, 1989). The NAAQS were adopted by reference in the Building Officials & Code Administrators (BOCA) National Mechanical Code of 1993 (BOCA, 1993), which is now an HVAC standard included in the Massachusetts State Building Code (SBBRS, 1997). According to the NAAQS established by the US EPA, carbon monoxide levels in outdoor air should not exceed 9 ppm in an eight-hour average (US EPA, 2000a).

Carbon monoxide should not be present in a typical, indoor environment. If it *is* present, indoor carbon monoxide levels should be less than or equal to outdoor levels. Outdoor carbon monoxide concentrations were non-detect or ND (Table 1). Carbon monoxide levels measured in the school were also ND (Table 1).

The US EPA also established NAAQS for exposure to particulate matter. Particulate matter is airborne solids that can be irritating to the eyes, nose and throat. The NAAQS originally established exposure limits for particulate matter with a diameter of 10 μm or less (PM10). According to the NAAQS, PM10 levels should not exceed 150 micrograms per cubic meter ($\mu g/m^3$) in a 24-hour average (US EPA, 2000a). This standard was adopted by both ASHRAE and BOCA. Since the issuance of the ASHRAE standard and BOCA Code, US EPA proposed a more protective standard for fine airborne particles. This more stringent, PM2.5 standard requires outdoor air particulate levels be maintained below 65 $\mu g/m^3$ over a 24-hour average (US EPA, 2000a). Although both the ASHRAE standard and BOCA Code adopted the PM10 standard for evaluating air quality, MDPH uses the more protective PM2.5 standard for evaluating airborne particulate matter concentrations in the indoor environment.

Outdoor PM2.5 concentrations were measured at 18 $\mu g/m^3$ (Table 1). PM2.5 levels measured indoors were in a range of 9 to 23 $\mu g/ m^3$ (Table 1). Thus, all measurements were below the NAAQS of 65 $\mu g/m^3$. Frequently, indoor air levels of particulates can be at higher levels than those measured outdoors. A number of mechanical devices and/or activities that occur in schools can generate particulates during normal operations. Sources of indoor airborne particulates may include but are not limited to particles generated during the operation of fan belts in the HVAC system; cooking in the cafeteria stoves and microwave ovens; use of photocopiers, fax machines and computer printing devices; operation of an ordinary vacuum cleaner and heavy foot traffic indoors.

Indoor air quality can also be negatively influenced by the presence of materials containing volatile organic compounds (VOCs). VOCs are carbon-containing substances that have the ability to evaporate at room temperature. Frequently, exposure to low levels of total VOCs (TVOCs) may produce eye, nose, throat and/or respiratory irritation in some sensitive individuals. For example, chemicals evaporating from a paint can stored at room temperature would most likely contain VOCs. In an effort to determine whether VOCs were present in the building, air monitoring for TVOCs was conducted. An outdoor air sample was taken for comparison. Outdoor TVOC concentrations were ND (Table 1). Indoor TVOC concentrations were also ND (Table 1).

Please note, TVOC air measurements are only reflective of the indoor air concentrations present at the time of sampling. Indoor air concentrations can be greatly impacted by the use TVOC containing products. While no TVOC levels measured exceeded background levels, materials containing VOCs were present in the school. Several classrooms had dry erase board markers and dry erase boards with trays filled with debris (Picture 16). In the kindergarten area, a dry erase board was observed at the breathing level of students who were sitting in a carpeted reading area. Materials such as dry erase markers and dry erase board cleaners may contain VOCs, such as methyl isobutyl ketone, n-butyl acetate and butyl-cellusolve (Sanford, 1999), which can be irritating to the eyes, nose and throat. Dry erase boards and markers should be used away from the breathing zone to prevent exposure to TVOCs, especially to sensitive individuals.

During the assessment, some staff indicated concerns regarding a rug in the reading area of a kindergarten classroom. According to the PS school nurse, Donna Linstrom, occupants of this classroom have experienced dry/itching eyes and sinus congestion when in the reading area. The throw rug used in this area has been cleaned; however, symptoms persist. As indicated previously, dry erase materials are also used in the breathing zone when occupants are sitting on the rug, which as discussed, can be irritating to the eyes, nose and throat. Discontinued use of dry erase materials in this area should reduce symptoms experienced by occupants sitting in this area. However, consideration should also be given to removing the rug.

Several other conditions that can affect indoor air quality were noted during the assessment. Filters for portable air conditioners (ACs) and fan blades for ceiling fans were observed to have accumulated dust (Pictures 17 and 18). Re-activated ACs can aerosolize dust accumulated on filters. These filters should be cleaned as per manufacturer's recommendations, or more frequently if necessary. Re-activated ceiling fans can also result in aerosolization of accumulated dust. In addition, a number of surfaces throughout the school were found with accumulated dust. Dust can be irritating to the eyes, nose and respiratory tract. Flat surfaces should be wet wiped and cleaned with a vacuum equipped with the high efficiency particulate arrestance (HEPA) filter on a regular basis.

Also of note was the amount of materials stored inside classrooms (Picture 19). In classrooms throughout the school, items were seen on windowsills, tabletops, counters, bookcases and desks. The amount of items stored provides a means for dusts, dirt and other potential respiratory irritants to accumulate. Many of the items (e.g., papers, folders, boxes) make it difficult for custodial staff to clean.

A number of classrooms contained upholstered furniture and pillows (Picture 20). These items are covered with fabric that comes in contact with human skin, which can leave oils, perspiration, hair and skin cells on the fabric. Dust mites feed upon human skin cells and excrete waste products that contain allergens. In addition, if relative humidity levels increase above 60 percent (e.g., during spring/summer), dust mites tend to proliferate (US EPA, 1992). In order to remove dust mites and other pollutants, frequent vacuuming of upholstered furniture is recommended (Berry, 1994). It is also recommended that if upholstered furniture were present in schools, it should be professionally cleaned on an annual basis or every six months if dusty conditions exist outdoors (IICRC, 2000).

Also of note is the location of pencil sharpeners. In some areas, pencil sharpeners were placed in front of personal fans (Picture 21). When fans are operating, pencil shavings can become airborne, providing a source of eye and respiratory irritation.

An inactive insect nest was suspended near a window (Picture 22). Nests can contain bacteria and may also be a source of allergenic material. Nests should be placed in resealable bags to prevent aerosolization of allergenic material. Nests should also be placed away from ventilation sources.

In addition, items should not be suspended from ceiling tile systems (Picture 23). Movement of ceiling tiles may aerosolize dust above ceiling tiles. Moreover, heavy items may damage the ceiling tile frames. Similarly, damaged ceiling tiles can also allow materials (e.g. dust, debris) to move from the ceiling plenum to occupied areas (Picture 24).

Lastly, re-use of food containers for storage was observed in several classrooms (Picture 25). Proper food storage is an integral component in maintaining indoor air quality. Food should be properly stored and clearly labeled. Reuse of food containers is not recommended since food residue adhering to the surface may serve to attract pests.

Conclusions/Recommendations

In view of the findings at the time of the assessment, the following recommendations are made:

1. Operate all ventilation systems that are operable throughout the building (e.g., gym, auditorium, classrooms) continuously during periods of school occupancy independent of thermostat control to maximize air exchange.
2. Examine each univent for function. Operate univents while classrooms are occupied. Check fresh air intakes for repair and increase the percentage of fresh air intake if necessary.
3. Remove all obstructions to supply vents and univents. Close classroom doors to improve air exchange.
4. Consult a ventilation engineer concerning re-balancing of the ventilation systems and the calibration of univent fresh air control dampers throughout the school. Ventilation industrial standards recommend that mechanical ventilation systems be balanced every five years (SMACNA, 1994).
5. For buildings in New England, periods of low relative humidity during the winter are often unavoidable. Therefore, scrupulous cleaning practices should be adopted to minimize common indoor air contaminants whose irritant effects can be enhanced when the relative humidity is low. To control for dusts, a high efficiency particulate arrestance (HEPA) filter equipped vacuum cleaner in conjunction with wet wiping of all surfaces is recommended. Avoid the use of feather dusters. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritations).
6. Replace water-stained ceiling tiles. Examine the areas above and around these tiles for mold growth. Disinfect areas of water leaks with an appropriate antimicrobial.

7. Examine plants in classrooms for mold growth in water catch basins. Disinfect water catch basins if necessary. Remove plants from ventilation sources and porous materials.
8. Examine the building exterior for breaches. Repair/seal breaches to prevent water intrusion to the building.
9. Clean dry erase board trays to prevent movement of particles. Refrain from using dry erase materials in the breathing zone.
10. Remove debris and dust accumulated on the ventilation grilles and fan blades. Clean window-mounted air -conditioner filters as per manufacturer's instructions or more frequently if needed
11. Ensure flat surfaces (e.g., window ledges and floors) are wet wiped and cleaned with a vacuum equipped with a HEPA filter on a regular basis.
12. Relocate pencil sharpeners away from fans.
13. Relocate or consider reducing the amount of materials stored in classrooms to allow for more thorough cleaning. Clean items regularly with a wet cloth or sponge to prevent excessive dust build-up.
14. Store nests in resealable bags, away from ventilation sources.
15. Consider adopting the US EPA document, *Tools for Schools* (US EPA, 2000b), as a means to maintaining a good indoor air quality environment in the building. This document can be downloaded from the Internet at http://www.epa.gov/iaq/schools/index.html.

16. Refer to resource manuals and other related indoor air quality documents for further building-wide evaluations and advice on maintaining public buildings. Copies of these materials are located on the MDPH's website: http://mass.gov/dph/indoor_air

References

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Picture 1

Classroom univent, note dust broom

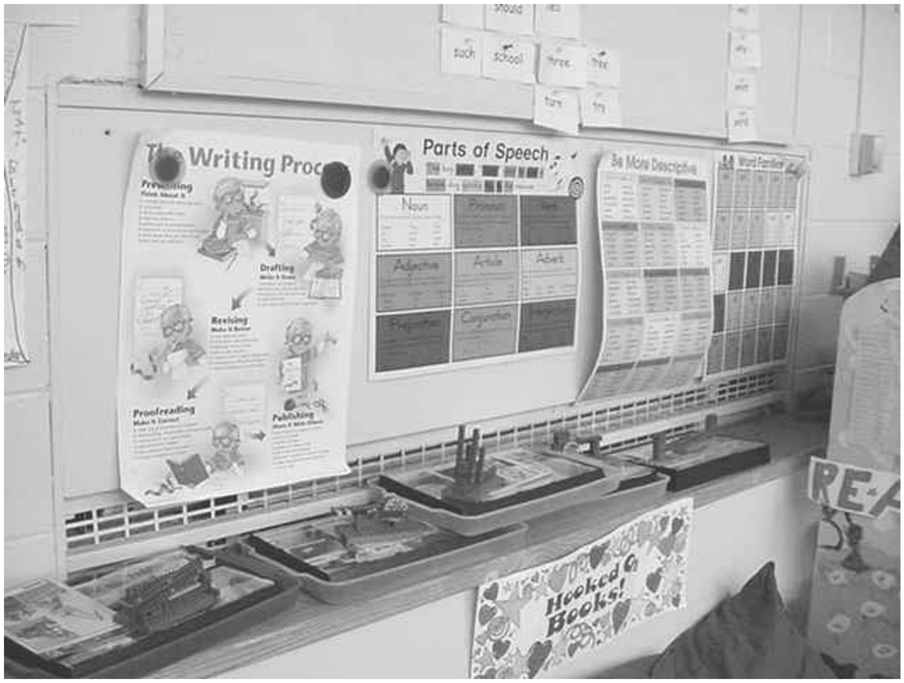
Picture 2

Univent fresh air intake

Picture 3

Obstructions to univent

Picture 4



Ledges at height of return vent

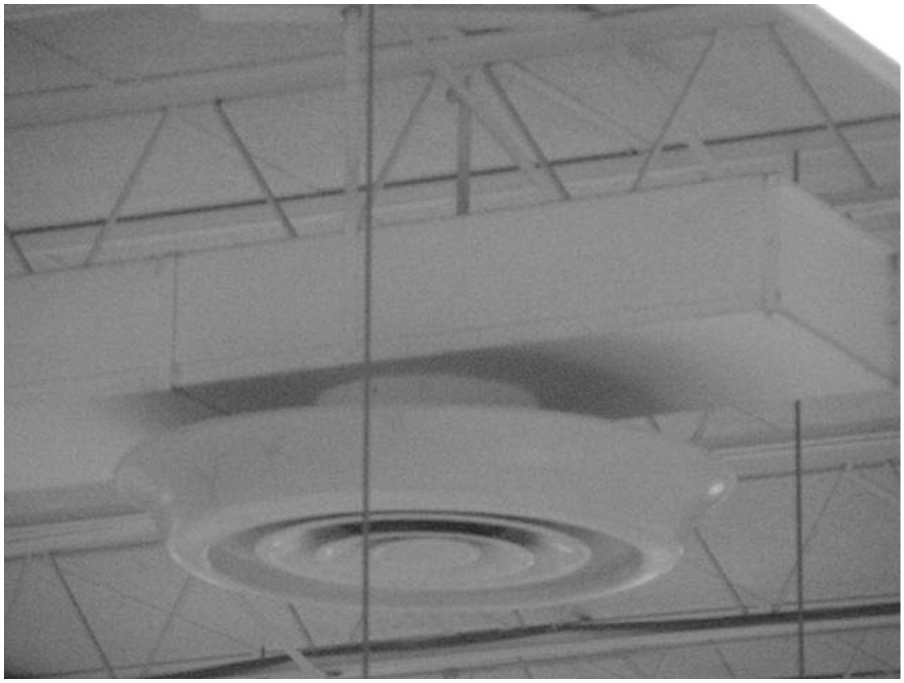
Picture 5

Classroom exhaust vent

Picture 6

Rooftop exhaust fan

Picture 7

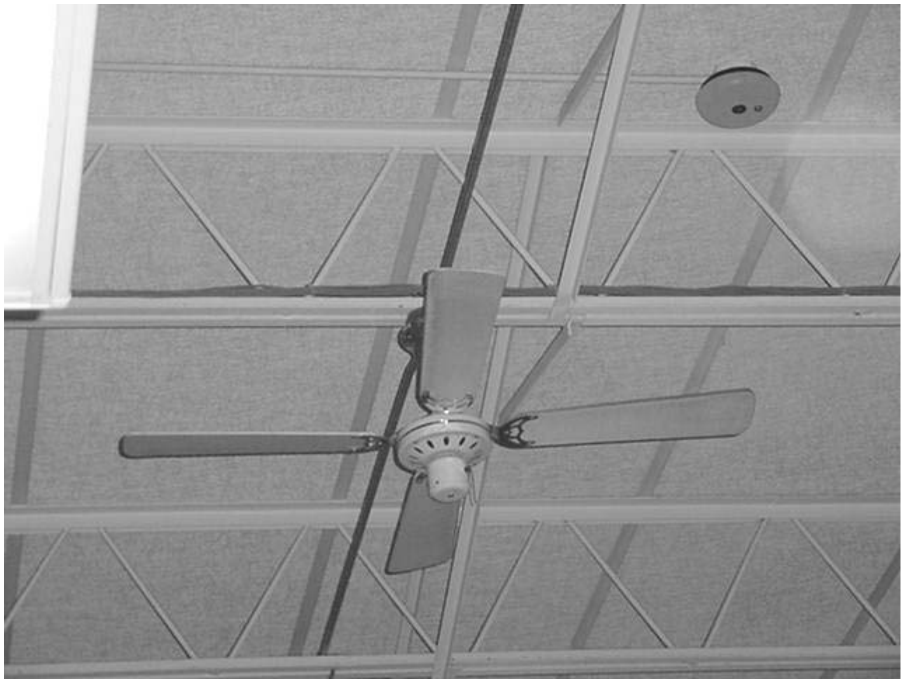


Ceiling supply diffusers

Picture 8

Wall-mounted exhaust vent

Picture 9



Ceiling--mounted fan

Picture 10

Water-stained ceiling tile

Picture 11

Plants on paper towels

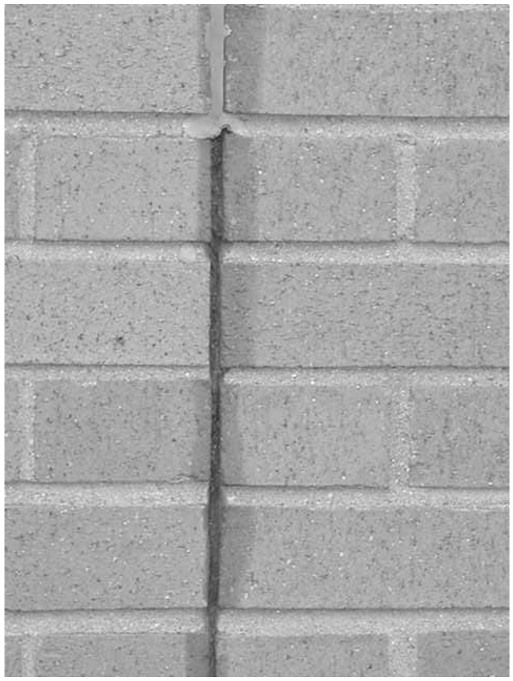
Picture 12

Plant on carpet

Picture 13

Flowering plants in close proximity to univent fresh air intake

Picture 14

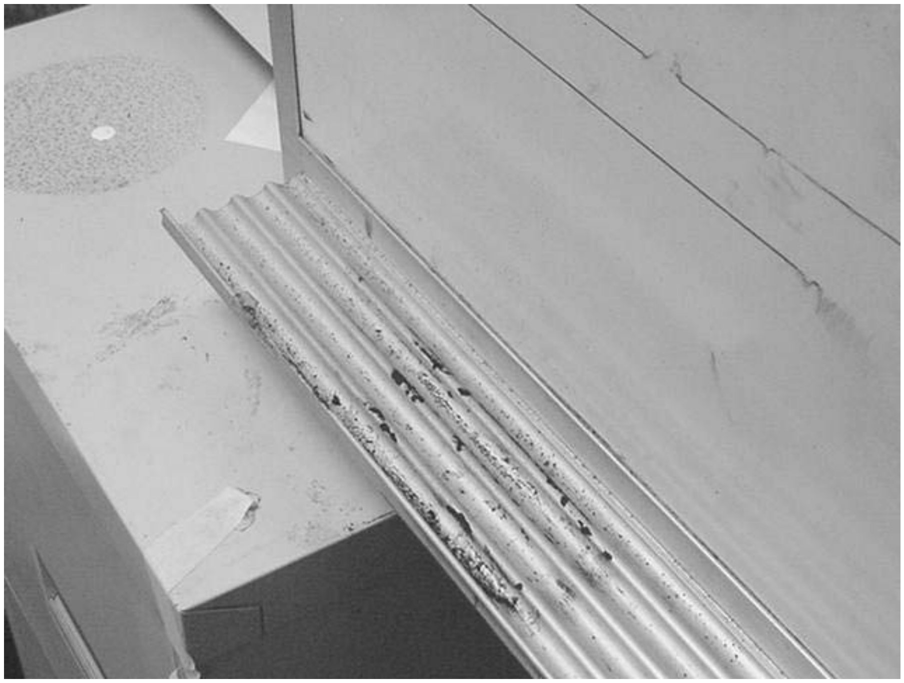


Breach in exterior wall

Picture 15

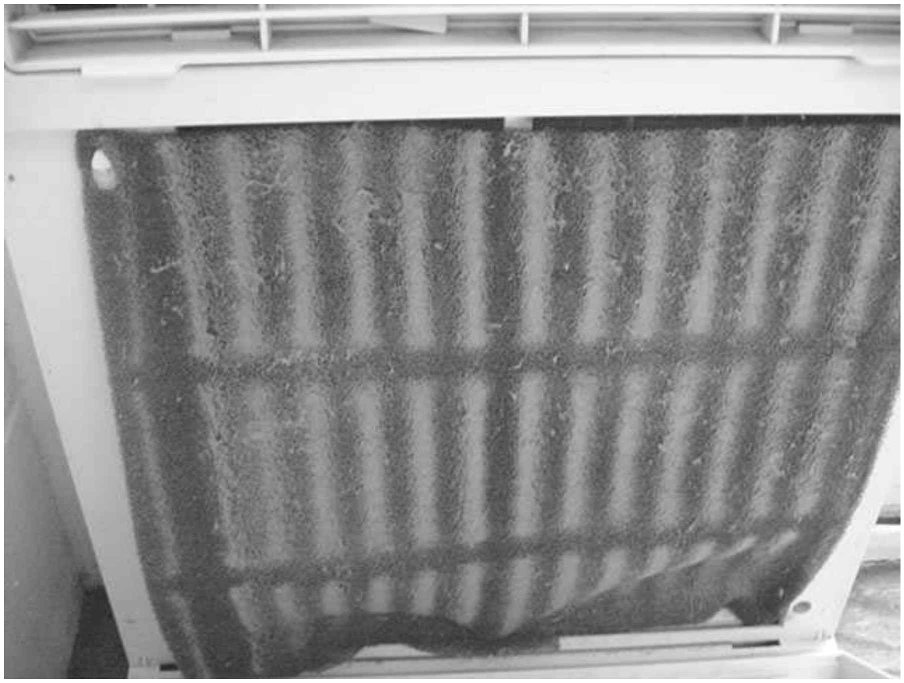
Damaged window frame

Picture 16



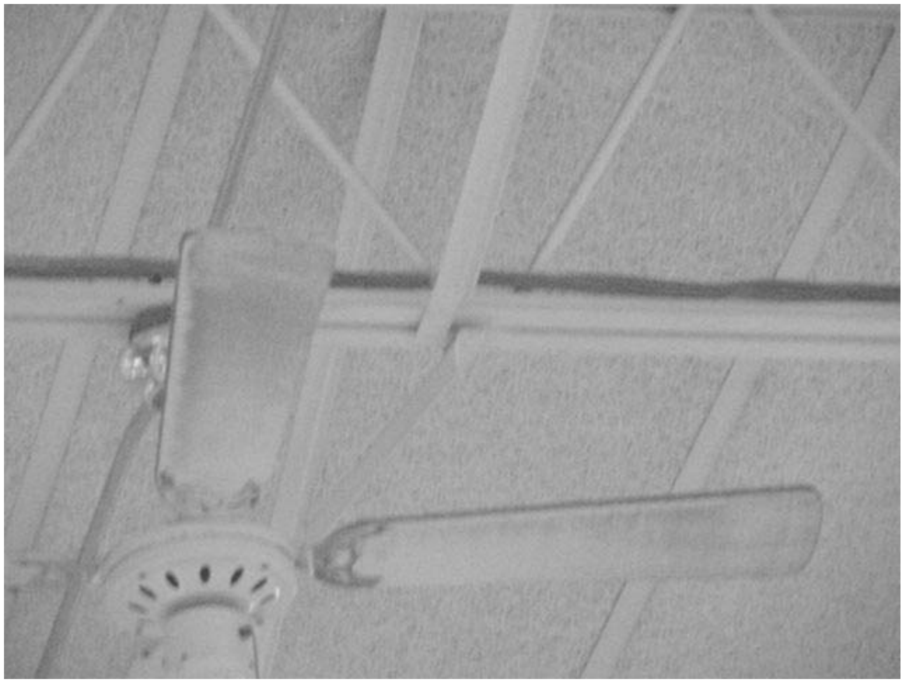
Dry erase marker dust in tray

Picture 17



Dust occluded air conditioner filter

Picture 18



Dust accumulated on fan blade

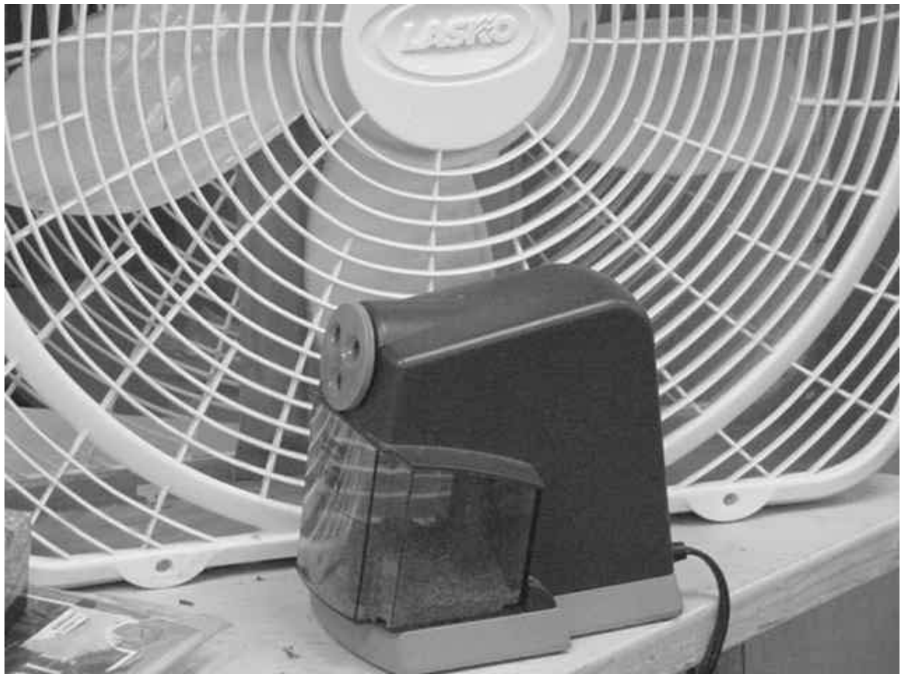
Picture 19

Amount of items in classroom

Picture 20

Upholstered pillows in classroom

Picture 21



Pencil sharpener placed in front of personal fan

Picture 22

Suspended insect nest

Picture 23

Items suspended from ceiling tile system

Picture 24

Damaged ceiling tile

Picture 25

Re-used food containers for storage

Pompositticut School | **Indoor Air Results**

511 Great Road, Stow, MA 01775 | **Date: 04/27/2005**

Table 1

Location/ Room	Occupants in Room	Temp (°F)	Relative Humidity (%)	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	TVOCs (ppm)	PM2.5 (µg/m3)	Windows Openable	Ventilation		Remarks
									Supply	Exhaust	
background		64	49	452	ND	ND	18	N # open: 0 # total: 0			drizzle, winds 10-15mph, parking lot near building 23 cars.
108	5	74	42	623	ND	ND	17	Y # open: 0 # total: 8	N	N	DEM.
111	0	74	46	693	ND	ND	22	N # open: 0 # total: 0	Y univent dust/debris	Y ceiling	CD.
115	0	73	47	648	ND	ND	13	Y # open: 0 # total: 8	N	N	Hallway DO, DEM, items.
122	0	73	45	542	ND	ND	9	Y # open: 0 # total: 2	Y univent	Y ceiling (weak)	Hallway DO, potential countertop blockage.
126	40	74	45	927	ND	ND	16	Y # open: 0 # total: 8	N		Hallway DO, plants.

ppm = parts per million
µg/m3 = micrograms per cubic meter

AD = air deodorizer
AP = air purifier
aqua. = aquarium
AT = ajar ceiling tile
BD = backdraft
CD = chalk dust
CP = ceiling plaster
CT = ceiling tile
DEM = dry erase materials
design = proximity to door
FC = food container
G = gravity
GW = gypsum wallboard
M = mechanical
MT = missing ceiling tile
NC = non-carpeted
ND = non detect
PC = photocopier
PF = personal fan
plug-in = plug-in air freshener
PS = pencil shavings
sci. chem. = science chemicals
TB = tennis balls
terra. = terrarium
UF = upholstered furniture
VL = vent location
WP = wall plaster

Comfort Guidelines

Carbon Dioxide: < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems

Temperature: 70 - 78 °F
Relative Humidity: 40 - 60%

Pompositticut School

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Indoor Air Results

Date: 04/27/2005

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Location/ Room	Occupants in Room	Temp (°F)	Relative Humidity (%)	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	TVOCs (ppm)	PM2.5 (μg/m3)	Windows Openable	Ventilation Supply	Ventilation Exhaust	Remarks
Akers	0	74	45	662	ND	ND	18	N # open: 0 # total: 0			DEM, FC re-use.
Alford 101	0	75	42	731	ND	ND	14	Y # open: 0 # total: 2	Y univent items	Y ceiling	Hallway DO, PF, FC re-use.
art	0	74	41	634	ND	ND	13	Y # open: 0 # total: 8	Y univent items dust/debris	Y ceiling	
Boissoneau	19	74	44	681	ND	ND	13	N # open: 0 # total: 0	Y ceiling	Y ceiling	DEM.
Bushe 167	24	73	47	1030	ND	ND	21	N # open: 0 # total: 0	Y univent	N	Inter-room DO, #WD-CT : 2, items hanging from CT.

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cafeteria	150	75	46	761	ND	ND	18	Y # open: 0 # total: 6	Y ceiling	Y wall	Hallway DO, #WD-CT : 2, #MT/AT : 1.
community	0	74	44	675	ND	ND	11	N # open: 0 # total: 0			FC re-use.
computers	1	74	43	684	ND	ND	15	Y # open: 0 # total: 8	Y univent boxes	Y ceiling	30 computers.
Dancey 165	20	73	47	856	ND	ND	17	Y # open: 0 # total: 6	Y univent (weak)	N	Hallway DO, #WD-CT : 1, DEM, items hanging from CT.
Elinoff 123	20	74	46	959	ND	ND	21	Y # open: 0 # total: 2	Y univent	Y ceiling	Hallway DO, DEM, items.
French	0	74	44	656	ND	ND	12	N # open: 0 # total: 0			DEM, PF, cleaners.

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Comfort Guidelines

Carbon Dioxide: < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems

Temperature: 70 - 78 °F
Relative Humidity: 40 - 60%

Pompositticut School | **Indoor Air Results**
511 Great Road, Stow, MA 01775 | **Date: 04/27/2005**

Table 1

Location/ Room	Occupants in Room	Temp (°F)	Relative Humidity (%)	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	TVOCs (ppm)	PM2.5 (µg/m3)	Windows Openable	Ventilation Supply	Ventilation Exhaust	Remarks
girls restroom	0	75	44	760	ND	ND		N # open: 0 # total: 0	N	Y wall	
Health	0	75	44	635	ND	ND	14	N # open: 0 # total: 0	Y ceiling (weak)	Y wall	#WD-CT : 2.
Hoffman	0	74	44	726	ND	ND	14	N # open: 0 # total: 0			DEM, UF, cleaners.
Jenney	0	75	43	741	ND	ND	17	N # open: 0 # total: 0			DEM, PF, PS, plants, Comments : PF near PS.
library	1	75	43	776	ND	ND	14	N # open: 0 # total: 0			dust, accumulated dust on library shelving.
Mainini 166	23	73	47	1041	ND	ND	23	Y # open: 0 # total: 2	N	N	Hallway DO, Inter-room DO, DEM.

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									Supply	Exhaust	
occupational therapy	2	75	43	688	ND	ND	15	N # open: 0 # total: 0			Hallway DO.
office	2	75	46	862	ND	ND	19	Y # open: 0 # total: 3	Y ceiling (weak)	N	Hallway DO, window-mounted AC, PC, photocopier in use.
principal	0	74	44	773	ND	ND	19	Y # open: 0 # total: 11	Y ceiling	N	Inter-room DO, window-mounted AC, plants, plants on carpeting.
reading room	0	73	50	650	ND	ND	12	Y # open: 2 # total: 8	Y univent (off)	Y ceiling	CD, DEM, PF, PS, items, plants, fan for UV on repair list.
teacher's lounge	6	74	47	719	ND	ND	16	Y # open: 0 # total: 6	Y ceiling	N	plants, coke machine.
Wallet 112	21	74	46	694	ND	ND	21	Y # open: 1 # total: 2	Y univent	Y ceiling	Hallway DO, DEM, dust, plants.

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									Supply	Exhaust	
Welby	1	74	43	666	ND	ND	14	N # open: 0 # total: 0	Y	Y	CD, DEM, PF, UF, items.
Ziobro	0	75	42	669	ND	ND	15	N # open: 0 # total: 0			DEM.

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